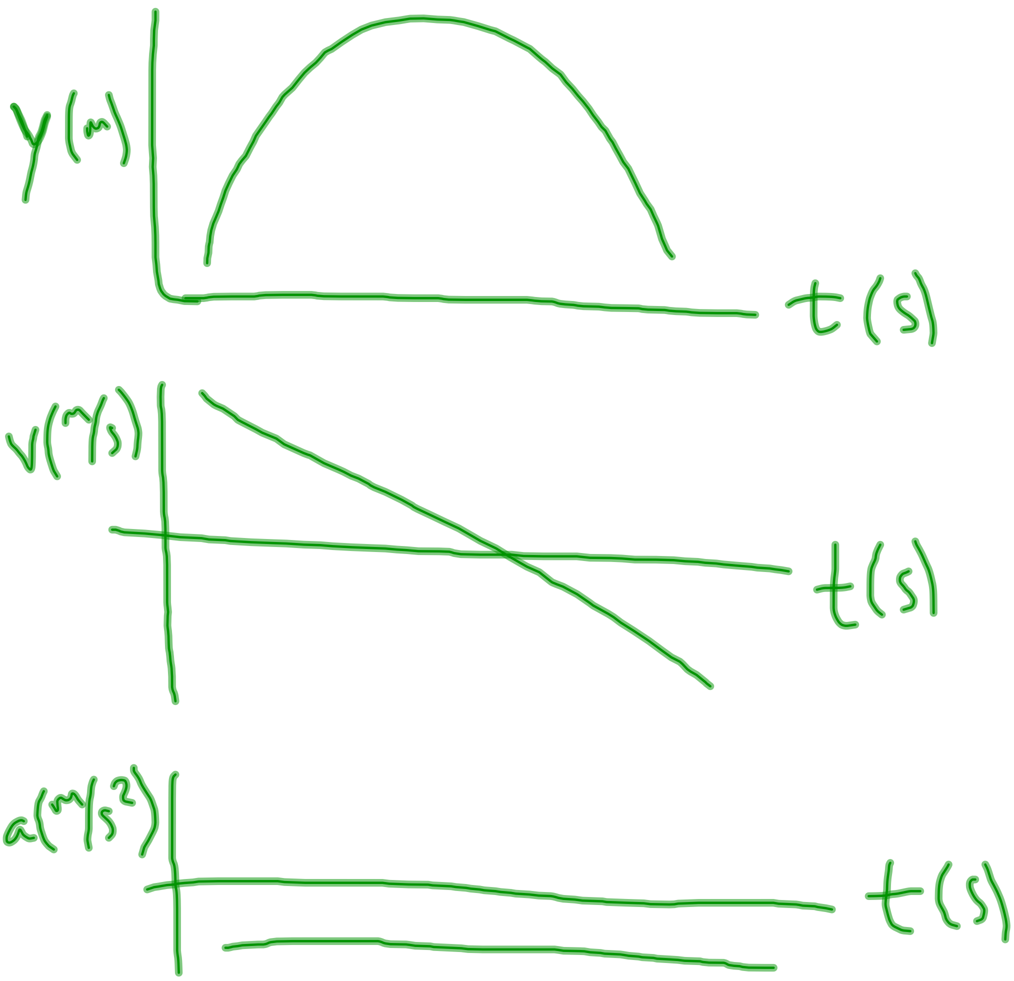
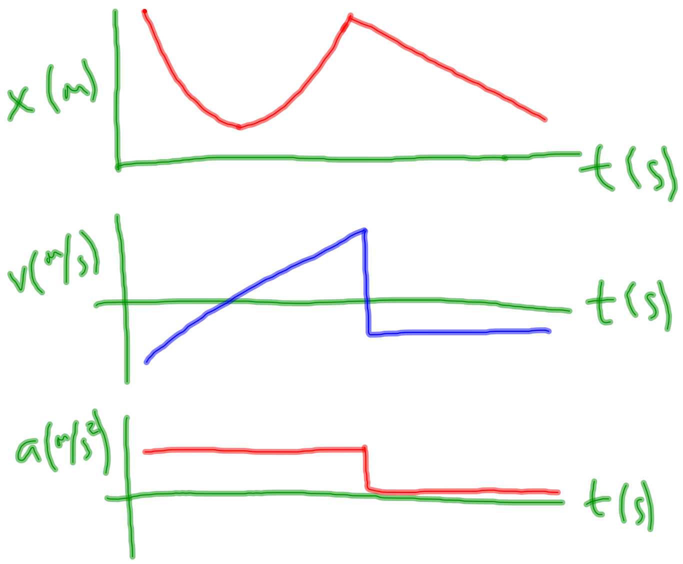
Test Review 1st Block 9.1.11

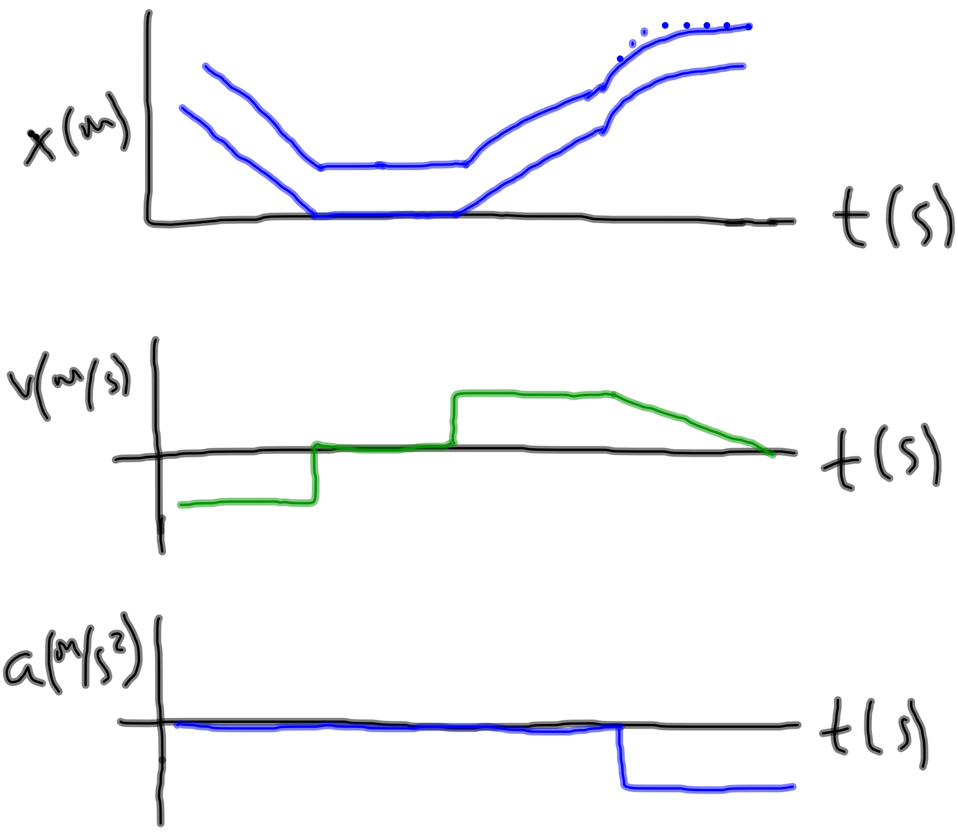
A coin is tossed vertically upward.
- What happens to its velocity while it is in the air? Draw a position v. time graph and velocity v. time graph to verify.
- Does its acceleration increase, decrease, or remain constant while it is in the air?



Initial Shape (d/t or v/t)	Mapping Shape (v/t or a/t)
Curve (/)	Line with slope (/)
Line with slope (/)	Horizontal Line not on time axis (—)
Horizontal line (—)	Horizontal line on time axis (—)

Initial Shape (v/t or a/t)	Mapping Shape (d/t or v/t)
Line with slope (/)	Curve (/)
Horizontal line not on time axis (—)	Line with slope (/)
Horizontal line on time axis (—)	Horizontal line (—)




x (m)
t (s)
v (m/s)
t (s)
a (m/s²)
t (s)

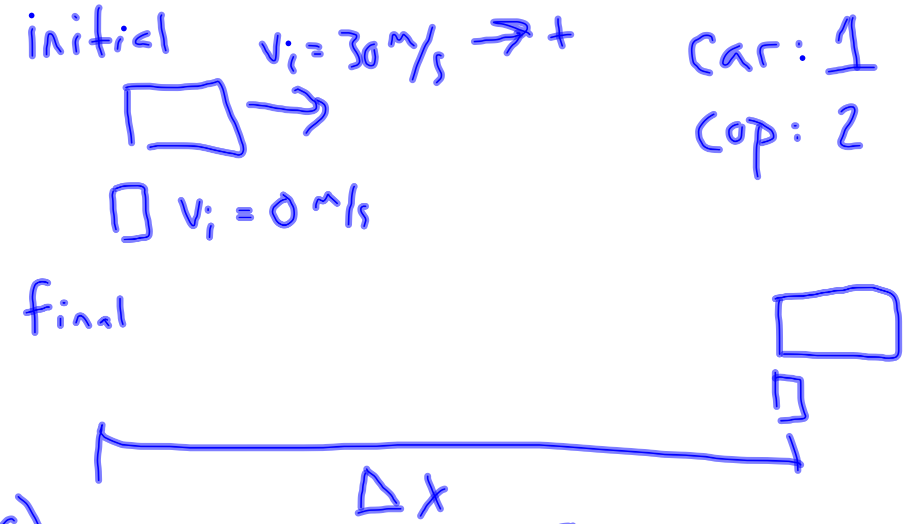
One-Dimensional Motion:

- Just in one direction → x or y
- In y-direction, acceleration is accel. due to gravity (9.8 m/s^2)
- Kinematics equations:
    - $\Delta x = v_i t + \frac{1}{2}at^2$
    - $v_f^2 = v_i^2 + 2a\Delta x$
    - $v_f = v_i + at$
- Often, motion of object looks like a parabola when plotted on displacement v. time graph

Variable	Unit
Δx or Δy	m
v_i	m/s
v_f	m/s
a	m/s^2
t	s

- Things to choose:
    - Positive/negative direction
    - Point of zero displacement

A speeder passes a parked police car at 30.0 m/s. The police car starts from rest with a uniform acceleration of 2.44 m/s/s.
a) How much time passes before the speeder is overtaken by the police car?
b) How far does the speeder get before being overtaken by the police car?



a)

$$\Delta x = v_{i1} t + \frac{1}{2} a_1 t^2 \quad (a_1 \to 0) \qquad \Delta x = v_{i2} t + \frac{1}{2} a_2 t^2 \quad (v_{i2} \to 0)$$

$$v_{i1} t = \frac{1}{2} a_2 t^2$$

$$v_{i1} = \frac{1}{2} a_2 t$$

$$t = \frac{2 v_{i1}}{a_2} = \frac{2(30\ m/s)}{2.44\ m/s^2} = 24.6\ s$$

b)

$$\Delta x = v_i t + \frac{1}{2} a t^2 \quad (a \to 0)$$

$$= (30\ m/s)(24.6\ s)$$

$$= 738\ m$$

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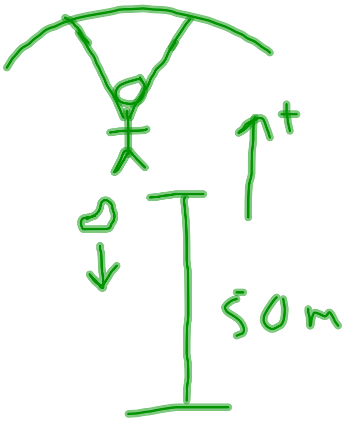
A parachutist descending at a speed of 10.0 m/s loses a shoe at an altitude of 50.0 m
a) When does the shoe reach the ground?
b) What is the velocity of the shoe just before it hits the ground?



b) $v_f^2 = v_i^2 + 2a_g\Delta y$

$v_f = \pm\sqrt{(-10\,m/s)^2 + 2(-9.8\,m/s^2)(-50\,m)}$

$= -32.9\,m/s$

a) $v_f = v_i + a_g t$

$t = \frac{v_f - v_i}{a_g}$

$= \frac{-32.9\,m/s - (-10\,m/s)}{(-9.8\,m/s^2)}$

$= 2.33\,s$